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Various approaches to assessing test score similarity have been used. One form of comparison, encompassing variability in both shape and elevation, is the generalized distance function (D), where D is the difference between two sets of scores. In this methodology, the profile of each member of the sample group is compared with the profile of every other member. The difference between the d score for each scale is calculated and squared. The total represents the profile discrepancies. Computer analysis then identifies profile types. This type of computer analysis is currently being done on freshman nursing students. The tests used include part of the nursing "battery," the Minnesota Multiphasic Personality Inventory (MMPI), and the woman's form of the Strong Vocational Interest Test (SVIB). The study is designed to provide information regarding prediction of success or failure in completing the nursing program. The use of the D methodology is expected to yield actuarial predictive data with practical significance. (IM)

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THE USE OF A $\underline{D}^2$ COMPUTER PROGRAM IN ESTABLISHING PERSONALITY TYPOLOGY ON THE MMPI & SVIB

Classifying human behavior into both discrete and meaningful categories has long been an aim and a concern of psychology. Classifying "normal" behavior is of particular importance in the area of counseling psychology. Many investigators have attempted to classify or identify "types" of people on the basis of similarity of test scores.

Various approaches to assessing test score similarity have been used. Similarity may be based on like configurations of scores; on patterns of test scores; by comparing two or more profiles for the same person; and by correlating one person's test profile with another persons (Q correlation). Osgood, Suci, and Cronbach added the use of a distance measure, called the generalized distance function, $\underline{D}$. In this measure $D = \sqrt{\Sigma d^2}$, where $\underline{d}$ is the difference between two sets of scores. This form of comparison is particularly applicable to profiles because, in effect, it encompasses variability in both shape and elevation.

Sines (1964) has recently investigated the use of a modification of the generalized distance function in generating profile prototypes from a personality inventory, the Minnesota Multiphasic (MMPI). Suppose we wanted to describe persons who are alcholic. The usual clinical approach to describing such behavior would involve giving a test and finding a mean profile for all alcholics taking the test. Sines' approach is the opposite of this -- he looks at the test results and then goes back and finds that a certain way of answering applies to a significantly greater number of alcholics than persons classified as non-alcholic, and may therefore be considered descriptive of certain aspects of their behavior. Although Sines and his

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collegues have used the methodology primarily with psychiatric patients, there is no reason to assume that it is not equally adaptable and applicable to a normal population. In this case, we have been using this approach on a population of freshman nursing students.

In this methodology, the profile of each member of the sample group is compared with the profile of every other member of the sample group. The difference between the T-scores (or d score) for each scale is calculated and squared. The total, or sum d^2, then represents the profile discrepancies.

In any sample group the sum d^2 chosen as the criterion, or cutting score, can be "tightened down" to assure little profile discrepancy or broadened which results in greater variability, depending on the type of sample, the type of test scores being compared and the nature of the particular research design being used. This job is done by a computer analysis.

After the d^2 analysis has been done by the computer, the program provides for sorting out those profiles that fall into prototype groups, i.e. those which are similar on the basis of T-scores over all the scales, and which meet the pre-determined d^2 criterion for similarity.

After the profile "types" are identified, all information available on the subjects is checked for behavioral descriptions. Judges are then asked to go through the available data and to complete a behavioral check list on which they tally descriptive terms. The number of subjects in each prototype group to which each descriptive term was attributed is then compared with subjects in a random sample drawn from the same general population sample. Any term which shows a statistically reliable difference (at the .05 level) be-

tween the item frequency for a particular profile type and the item frequency for the control sample is then considered to be descriptive of the behavior of persons in that profile prototype.

So far we have run this type of computer analysis on freshman students enrolled in the University's School of Nursing. The tests used have been part of the nursing "battery", the Minnesota Multiphasic Personality Inventory (MMPI) and the woman's form of the Strong Vocational Interest Test (SVIB). All available MMPI and SVIB protocols of freshman nursing students tested from 1962-1967 were obtained for the data pool.

The research we are engaged in is designed to provide information regarding prediction of success or failure in completing the nursing program. At the present time, only about one-half of our student nurses complete the 4 year B.S. program. This involves not only a great deal of time and expenditure on the parts of both the students and the administration, but seriously cuts into the available number of graduating nurses so vitally needed in the profession.

There seem to be two critical times in the program when nursing students tend to drop out. The first occurs, as in any other area, at the end of the first semester of the freshman year. The drop-out at this time is largely due to academic difficulty and can be adequately regulated simply by upping the predicted GPA required for admission into the program. The use of the D approach, however, might serve to identify characteristics of girls who are likely to drop out or fail in spite of expected or predicted academic success.

The second "critical" time is during the student nurses "clinical practicum". The students enter this phase of training at the beginning of

their junior year and it involves actual clinical work in four out of six special areas of nursing: medical-surgical; child; obstetrics and gynecology; psychiatric; public health; and senior nursing. Many of our prospective nurses transfer out of the program at this time and go into other areas; others fail to make adequate grades in these courses. Extensive studies by Taylor and others have shown that the traditional predictors of academic performance (ability and past academic performance) do not successfully predict clinical practicum grades. Investigators have turned, then, to non-intellective factors such as personality characteristics or interest patterns as possible predictors; but so far when relationships have been found, they have had statistical but not practical significance for differential prediction. In our studies the use of the D methodology is expected to yield actuarially predictive data which will have practical significance.

The prototypes derived from both the MMPI and SVIB data are being compared against a number of criterion measures, e.g. graduated, non-graduated, transferred, dropped out, academic failure in pre-clinical or clinical courses, success or failure in certain critical courses (like anatomy), SCAT scores, time entering the program, etc. Predictions based on the statistical frequency of certain behaviors occuring will then be made regarding each prototypic group. These predictions will then be cross-validated on a "hold-out" group that has been held out of the original sample, and the statistical significance of the results will be determined. Actuarial formulae may then be developed regarding the expected behaviors of persons falling into any prototypic group with respect to several criteria.

At this time only a few results are available: We have found that girls entering the nursing program at times other than the regular fall semester (that

is, in the summer or spring semester) do not graduate from the program with statistically greater significance than girls entering the program in the fall. Also, girls generating a 9'4 pattern on the MMPI (that is, Manic scale over 70 and Psychopathic scale codable) do not succeed in clinical practicum courses with statistically greater significance than girls generating various other types of MMPI profiles.

While this research is still on-going, we feel it has excellent possibilities for prediction of such criterion as success or failure in academic programs or in other types of prediction where non-intellective factors may be considered important variables.